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EOSDIS Core System Project

Maintainability Predictions for the ECS Project

Preliminary

March 1995

Hughes Applied Information Systems
Landover, Maryland

Maintainability Predictions for the ECS Project

Preliminary

March 1995

Prepared Under Contract NAS5-60000
CDRL Item 091

APPROVED BY

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Preface

This document is a formal contract deliverable with an approval code 3. As such, it is delivered to GSFC for information purposes only, but is subject to approval as meeting contractual requirements. Changes to this document shall be made by document change notice (DCN) or by complete revision.

Once approved, this document shall be under the ECS Project Configuration Control. Any questions should be addressed to:

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Change Information Page

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1. Introduction

1.1 Identification of Document

This Maintainability Predictions Report, Contract Data Requirements List (CDRL) Item 091, whose requirements are specified in Data Item Description (DID) 518/PA3, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

1.2 Scope of Document

This report is the first iteration of a continuous and iterative maintainability prediction process that assesses the predicted ECS hardware maintainability based on the hardware configuration presented at the Segment Preliminary Design Review (PDR) time frame which is the Release A/B configuration. This includes hardware used in the Flight Operation Segment (FOS) for Release A/B, Communications and Systems Management Segment (CSMS) Release A, and Science and Data Processing Segment (SDPS) Release A. For Release A, the applicable Distributed Active Archive Center (DAAC) sites for CSMS and SDPS are Goddard Space Flight Center (GSFC), Earth Resources Observations System (EROS) Data Center (EDC), Marshall Space Flight Center (MSFC), and Langley Research Center (LaRC).

Since specific hardware Commercial Off The Shelf (COTS) vendors have not been identified at the PDR time frame, this report provides the existing generic hardware maintainability database, which preliminary ECS functional availability assessments have been based on. The report also presents the maintainability prediction methodology, ground rules and assumptions in accordance with MIL-HDBK-472, Prediction Procedure II, which are required when specific COTS vendor data or comparable vendor data is not available.

This document reflects the Technical Baseline submitted via contract correspondence number ECS 194-00343.

1.3 Purpose and Objectives of Document

The Maintainability Predictions report provides the ECS predicted hardware maintainability data to support the availability modeling activity which was documented in DID #515/PA2, Availability Models/Predictions. Maintainability prediction is a continuous and iterative process throughout the program life cycle to ensure that the ECS system will achieve its functional availability requirements. This task is performed early in the design process or once hardware is identified, in order to be an effective aid in evaluating the ECS design by providing information that can be used as the basis for design decisions such as redundancy, fault management design approach, accessibility to facilitate repair, and hot switchable LRUs.

The maintainability prediction procedure highlights for the designer, those areas of poor maintainability which justify product improvement, modification, or a change of design. It also permits the user to make an early assessment of whether the predicted downtime, quality and

quantity of personnel, tools and test equipment are adequate and consistent with the needs of system availability requirements.

Results from this report will be used to ensure that the Segment Level 4 RMA requirements are appropriately allocated and to serve as inputs for determining life cycle costs, sparing requirements, and maintenance planning.

1.4 Document Status and Schedule

This submittal of DID 518/PA3 meets the milestone specified in the Contract Data Requirements List (CDRL) of NASA Contract NAS5-60000. The next updated version of the Predictions Report will be submitted two weeks prior to the System Critical Design Review (CDR). Subsequent maintainability prediction updates for each release configuration will be submitted at each release Incremental Design Review (IDR), CDR and throughout the ECS life cycle.

1.5 Document Organization

The document is organized into five (5) sections, one Abbreviation and Acronyms and one Appendix:

- | | |
|------------|--|
| Section 1 | Introduction, contains the identification, scope, purpose and objectives, status and schedule, and document organization. |
| Section 2 | Related Documentation, provides a bibliography of parent, applicable and information documents for the Maintainability Predictions. |
| Section 3 | ECS Maintainability Predictions Methodology, describes the maintainability requirements, vendor data, prediction technique, assumptions and ground rules, and prediction worksheets. |
| Section 4 | Other MTTR Data Sources, describes GFE provided data. |
| Section 5 | Maintainability Prediction Data, describes the maintainability data for the FOS, SDPS, and CSMS. |
| Appendix A | Maintainability Data, provides detailed spreadsheets divided into three sections. One for FOS, one for SDPS and one for CSMS hardware. |

Abbreviations and Acronyms

2. Related Documentation

2.1 Parent Documents

The parent documents are the documents from which this Maintainability Predictions document scope and content are derived.

194-207-SE1-001	System Design Specification for the ECS Project
420-05-03	Earth Observing System (EOS) Performance Assurance Requirements for the EOSDIS Core System (ECS)
423-41-01	Goddard Space Flight Center, EOSDIS Core System (ECS) Statement of Work
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System (ECS)
423-41-03	EOSDIS Core System (ECS) Contract Data Requirements Document

2.2 Applicable Documents

The following documents are referenced within this Maintainability Predictions document, and are directly applicable, or contain policies or other directive matters that are binding upon the content of this volume.

194-501-PA1-001	Performance Assurance Implementation Plan for the ECS Project
194-502-PA1-001	Contractor's Practices & Procedures Referenced in the PAIP for the ECS Project
515-CD-001-002	Availability Models/Predictions for the ECS Project
516-CD-001-002	Reliability Predictions for the ECS Project
613-CD-001-001	COTS Maintenance Plan for the ECS Project
MIL-HDBK-472	Military Handbook: Maintainability Predictions

2.3 Information Documents

The following documents, although not referenced herein and/or not directly applicable, do amplify or clarify the information presented in this document. These documents are not binding on the content of the Maintainability Predictions document.

MIL-STD-470B	Military Standard: Maintainability Program for Systems and Equipment
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3. ECS Maintainability Predictions Methodology

3.1 Maintainability Prediction Requirements

The ECS design uses state-of-the-art COTS hardware to meet requirements and take advantage of the rapidly changing technology; therefore, the primary source for maintainability data is COTS vendor supplied data.

Maintainability Predictions are required to support the Availability Modeling/Prediction activity (DID 515/PA2). The maintainability data supporting the maintainability predictions will be obtained or developed in the following order of priority in accordance with the ECS performance requirements of Paragraph 5.4.2 in document 420-05-03:

- 1) COTS vendor supplied maintainability data will be utilized at the purchased hardware unit level. If this data is unavailable;
- 2) Historical or comparable data for like hardware items using similar technologies and construction/packaging will be utilized. If this data is unavailable;
- 3) A Maintainability Prediction will be performed on the hardware per MIL-HDBK-472, Prediction Procedure II. This maintainability prediction will use equipment drawings as well as a list of standard equipment repair times provided by the COTS vendors.

3.2 Vendor Data

All COTS vendors will be required to provide maintainability values down to the LRU level with their identified source. Maintainability data sources can be either of the following:

- a. Field service data,
- b. Test data,
- c. Predicted data.

Vendor maintainability data will be collected by EDS as part of the procurement process. ECS Systems Maintainability engineers will participate in this process to ensure the validation and integrity of the maintainability data. This process is detailed in document 194-502-PA1-001, Contractor's Practices & Procedures Referenced in the PAIP for the ECS Project, Project Instruction RM-1-002, Control of COTS Subcontractors and Suppliers. Figure 3.2-1 presents the COTS vendor maintainability data flow process for the ECS program. This data will first be recorded in the Integrated Logistic System (ILS) database called Vendor Costing And Tracking System (VCATS). The Systems Engineering group will then receive a report identifying the hardware description, vendor, and maintainability data. This data is then used as the basis for the maintainability predictions for each segment and is shown in Appendix A.1 for FOS, Appendix A.2 for SDPS, and Appendix A.3 for CSMS. If vendor data on specific COTS products is not available, historical or comparable data for like hardware using similar technology in similar environments will be utilized if available and acceptable. In the case where vendor maintainability

data is unavailable, COTS vendor equipment drawings as well as the vendor's list of standard equipment repair times will be requested from the vendor. Maintainability prediction worksheets will be completed and their output will become part of the Maintainability Predictions Report.

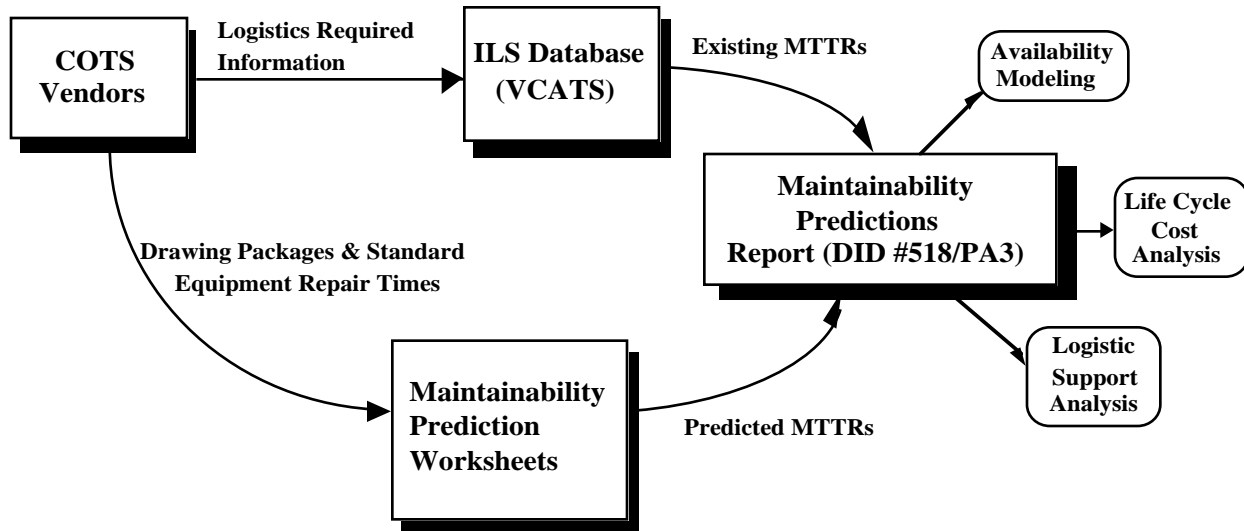


Figure 3.2-1. COTS Vendor Maintainability Data Flow Process

3.3 Maintainability Prediction Technique of MIL-HDBK-472, Procedure II

If vendor maintainability data is unavailable and no historical or comparable data is available for like items using similar technologies and construction/packaging, a maintainability calculation will be made using the methodology defined in MIL-HDBK-472, Procedure II. The general mathematical expression for equipment MTTR using this method is:

$$MTTR = \frac{\sum_{i=1}^n \lambda_i M_{c_i}}{\sum_{i=1}^n \lambda_i}$$

λ_i = i^{th} Subassembly's or Line Replaceable Unit's (LRU) failure rate in failures per million hours

M_{c_i} = i^{th} LRU's corrective maintenance repair time in hours

n = total number of LRUs

MTTR = Mean Time To Repair in hours

The value for M_C will be calculated using the Maintainability Prediction Worksheets described in Section 3.4.

3.4 Assumptions and Ground Rules

The following are assumptions and ground rules for the ECS maintainability predictions in accordance with MIL-HDBK-472, Prediction Procedure II:

- 1) Maintainability predictions will be performed using the LRU level data. All maintenance task times associated with the LRUs will be listed on the maintainability prediction worksheet (Figure 3.5-1) in conjunction with their failure rates (taken from the Reliability Predictions document, DID 516/PA2) to produce the MTTR results.
- 2) The Maintainability Prediction will be based on corrective maintenance task times. Corrective maintenance is the maintenance performed to restore an item to a satisfactory condition by providing correction of a malfunction which has caused degradation of the item below its specified performance level.
- 3) Corrective maintenance times include only actual repair time which is the period when repair work is in progress. Therefore, it excludes such parameters of measure as administrative time or logistic time, etc.
- 4) The Preventive Maintainability task times will be taken into consideration by the ILS group for scheduling and manpower requirements. Preventive maintenance is the maintenance performed to retain an item in satisfactory operational condition by providing systematic inspection, detection, and prevention of incipient failures. Preventive maintenance can be either scheduled or unscheduled depending upon the requirements of the mission.
- 5) The Administrative Logistics Delay Time (ALDT) will be determined based on each site's maintenance concept documented in the ECS COTS Maintenance Plan, 613-CD-001-001, and on the individual hardware. For preliminary prediction purposes the average estimated Administrative Logistics Delay Time (ALDT) is two (2) hours. The Mean Down Time (MDT) as shown in Appendix A is equal to the MTTR plus the ALDT. The MDT value is used by the Availability Models/Predictions, 515-CD-001-001.

3.5 MTTR Calculation Worksheets

The ECS maintainability prediction method described in this document depends upon utilizing the estimated Maintenance Task Times required for performing the specific maintenance tasks which, in total, comprise a repair or maintenance action. These Maintenance Task Times are listed in the following Figure 3.5-1, Maintainability Prediction Worksheet.

System_____

Page___Of___

Segment_____

Date_____

Element/Function_____

Prepared By_____

Approved By_____

[-----Maintenance Task Times-----]											
LRU Description	LRU Part Number	Failure Rate (λ)	Localization	Isolation	Disassembly	Interchange	Reassembly	Alignment	Checkout	Repair Time (M_c)	Failure Rate x Repair Time (λM_c)
		$\lambda =$								$\lambda M_c =$	

Figure 3.5-1. Maintainability Prediction Worksheet

The Maintainability Prediction worksheet is completed for each piece of hardware requiring a predicted MTTR. The hardware is broken down into LRUs. Each LRU is entered into a row in the worksheet. The LRUs failure rate (λ) is taken from the Reliability Predictions document, DID 516/PA2. The Maintenance Task Times are then entered in hours.

The following are descriptions of the seven Maintenance Tasks Times:

- Localization - Determining the location of a failure to the extend possible, with the assistance of Built-In-Test (BIT) capability but without using accessory equipment.
- Isolation - Determining the location of a failure to the extend possible, with the assistance of Built-In-Test (BIT) capability but by the use of accessory test equipment.
- Disassembly - Equipment disassembly to the extend necessary, to gain access to the item that is to be replaced.

- d. Interchange - Removing the defective item and installing the replacement.
- e. Reassembly - Closing and reassembling of the equipment after the replacement has been made.
- f. Alignment - Performing any alignment, minimum tests and/or adjustment made necessary by the repair action.
- g. Check Out - Performing checks or tests required to verify that the equipment has been restored to satisfactory performance.

The calculations made in the Maintainability Prediction Worksheet in Figure 3.5-1 are as follows:

- 1) The sum of the Maintenance Task Times equals the Repair Time (M_c).
- 2) The Repair Time (M_c) is multiplied by the failure rate (λ) of the LRU, expressed in failures per million hours (FPMH), to obtain an estimate of the number of maintenance hours (λM_c) for that specific maintenance or repair action.
- 3) The maintenance hours are summed (λM_c).
- 4) The failure rates are summed (λ).
- 5) The MTTR is calculated by dividing the summed maintenance hours by the summed failure rates ($\lambda M_c / \lambda$).

The equation used for this calculation was defined earlier in Section 3.3. The MTTRs for each piece of hardware is shown in Appendix A.1 for FOS, A.2 for SDPS, and A.3 for CSMS.

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4. Other MTTR Data Sources

4.1 Government Furnished Equipment (GFE) Provided Data

When the GFE list in the Government Furnished Property for the ECS document, 828-RD-001-002, is updated at PDR, the required ECS functional availability strings associated with the GFE will be identified and maintainability data will be requested from the ESDIS Project Office to provide adequate maintainability information. The data will be used for performing required maintainability analyses.

A GFE list will not be requested for the FOS since there is no GFE within its functional availability requirements strings. Maintainability data will be requested from the ESDIS Project Office for CSMS and SDPS as soon as an updated GFE list is produced and items associated with the CSMS and SDPS functional availability requirements strings are identified.

The identified CSMS and SDPS GFE lists and their maintainability data will be included in future reports.

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5. Maintainability Prediction Data

The maintainability data presented in Appendix A is divided into three sections. Each section contains a segment. The first section A.1 contains FOS maintainability data, the second section A.2 contains SDPS maintainability data, and the third section A.3 contains CSMS maintainability data.

The definition for each worksheet column follows:

<u>Column Title</u>	<u>Description</u>
Site	Physical location of hardware
Subsystem	Subsystem where hardware resides
Rel	Release in which hardware is delivered
Qty	Number of items used in this subsystem
Item Description	Hardware name and/or description
Model	Manufacturer model number of hardware
MTTR	Mean Time To Repair
MDT	Mean Down Time
Data Source	Source of MTTR data. (i.e. Vendor, Parts Count Prediction, NPRD, Similar to..., etc.)

5.1 Flight Operations Segment (FOS) Maintainability Prediction Data

At the FOS System Wrap-Up PDR time frame no specific COTS hardware vendors have been identified. Therefore, existing maintainability prediction data of "similar to" or generic type of hardware needed to support the FOS availability models is provided in Appendix A.1 with their associated Mean Time To Repair (MTTR) and source of data.

As the FOS design becomes more refined, specific COTS hardware vendors that do not have maintainability data will be identified and vendor maintainability data will be obtained for the maintainability prediction worksheets. Appendix A.1 will then be updated with the actual FOS hardware maintainability data.

5.2 Science Data Processing Segment (SDPS) Maintainability Prediction Data

A sample of SDPS hardware is provided in Appendix A.2 with their associated Mean Time To Repair (MTTR) and source of data.

As the SDPS design becomes more refined, specific COTS hardware vendors that do not have maintainability data will be identified and vendor maintainability data will be obtained for the maintainability prediction worksheets. Appendix A.2 will then be updated with the actual SDPS hardware maintainability data.

5.3 Communications and System Management (CSMS) Maintainability Prediction Data

Existing maintainability prediction data of "similar to" or generic type of hardware needed to support the CSMS availability models is provided in Appendix A.3 with their associated Mean Time To Repair (MTTR) and source of data.

As the CSMS design becomes more refined, specific COTS hardware vendors that do not have maintainability data will be identified and vendor maintainability data will be obtained for the maintainability prediction worksheets. Appendix A.3 will then be updated with the actual CSMS hardware maintainability data.

Appendix A. Detailed MTTR Prediction Data

A.1 Flight Operations Segment (FOS) Maintainability Prediction Data

FOS COTS Hardware RMA Data For Releases A and B

Site	Subsystem	Rel.	Qty	Item Description	Model	MTTR	MDT	Data Source
GSFC	EOC	A/B	2	Real Time Server:256MB,4GB,CDROM, 4MMDAT,Dual FDDI Card	TBD	1.00	3.00	Vendor
GSFC	EOC	A/B	2	Data Server:256MB,4GB,CDROM, 4MMDAT,Dual FDDI Card	TBD	1.00	3.00	Vendor
GSFC	EOC	A/B	36	User Station: 64MB,2GB, CD ROM, Ethernet Card	TBD	1.10	3.10	Vendor
GSFC	EOC	A/B	2	100/10BaseT Hub	TBD	2.00	4.00	Vendor
GSFC	EOC	A/B	2	EOC Router	TBD	0.50	2.50	Vendor
GSFC	EOC	A/B	2	Time System	TBD	0.50	2.50	Vendor
GSFC	EOC	A/B	2	RAID Front End Processor: 64MB,2GB, CD ROM, Ethernet Card	TBD	1.10	3.10	Vendor
GSFC	EOC	A/B	1	RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
GSFC	EOC	A/B	7	Laser Printer	TBD	1.50	3.50	Vendor
GSFC	EOC	A/B	5	Line Printer	TBD	0.25	2.25	Vendor
GSFC	EOC	A/B	5	Color Printer	TBD	0.25	2.25	Vendor
GSFC	EOC	A/B	1	COLOR TV (VIDEO MONITOR)	TBD	0.25	2.25	Vendor

Note: MDT = MTTR + ALDT

ALDT = 2 hours

A.2 Science Data Processing Segment (SDPS) Maintainability Prediction Data

SDPS COTS Hardware RMA Data For Release A and B (1 of 2) (Sample)

Site	Subsystem	Rel.	Qty	Item Description	Model	MTTR	MDT	Data Source
	DATA LOC/ORD	A		MED FILE SERVER 16MB 665 MB HD	TBD	1.00	3.00	Vendor
	DATA LOC/ORD	A		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	DATA LOC/ORD	A		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	DB MAINT.	A		WRKSTN W/16MB 664 MB HD	TBD	1.10	3.10	Vendor
	ALG. TEST&INT	A		WRKSTN W/16MB 664 MB HD	TBD	1.10	3.10	Vendor
	SCIENCE PROC	A		WRKSTN W/16MB 665 MB HD	TBD	1.50	3.50	Vendor
	SCIENCE PROC	A		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	SCIENCE PROC	A		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	SCIENCE PROC	A		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	SCIENCE PROC	A		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	A		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	A		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	A		AUTOMATED TAPE LIBRARY	TBD	4.70	6.70	Vendor
	ARCHIVE MGR	A		OPTICAL TAPE DRIVE/3480 TYPE	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	A		WRKSTN W/16MB 664 MB HD	TBD	1.10	3.10	Vendor
	INGEST/DIST	A		SERVER	TBD	2.00	4.00	Vendor
	INGEST/DIST	A		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	INGEST/DIST	A		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	INGEST/DIST	A		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	INGEST/DIST	A		X WINDOW TERMINAL	TBD	0.70	2.70	Vendor
		A		LASER PRINTER 4PPM	TBD	1.00	3.00	Vendor
	PGS	A		LASER PRINTER 4PPM	TBD	1.00	3.00	Vendor
	DADS	A		LASER PRINTER 4PPM	TBD	1.00	3.00	Vendor
	DADS	A		DUAL ACCESS MASTER TAPE DRIVE	TBD	2.50	4.50	Vendor
	DADS	A		3480 COMPATIBLE DRIVE W/ACL	TBD	2.50	4.50	Vendor
	DADS	A		3480 COMPATIBLE DRIVE W/ACL	TBD	2.50	4.50	Vendor
	DADS	A		8MM CASSETTE TAPE DRIVE	TBD	2.50	4.50	Vendor
	DADS	A		8MM CASSETTE TAPE DRIVE	TBD	2.50	4.50	Vendor
	DADS	A		CD-ROM ENCODER/WRITER	TBD	2.00	4.00	Vendor
	DADS	A		REWRITABLE OPTICAL DRIVE 5.25"	TBD	2.50	4.50	Vendor
	DADS	A		OPTICAL DISK DRIVE	TBD	2.00	4.00	Vendor
	DADS	A		OPTICAL CHARACTER READER	TBD	2.00	4.00	Vendor

SDPS COTS Hardware RMA Data For Release A and B (2 of 2)
(Sample)

Site	Subsystem	Rel.	Qty	Item Description	Model	MTTR	MDT	Data Source
	DADS	A		SCANNING SUBSYSTEM	TBD	1.00	3.00	Vendor
	DADS	A		MUTIPRINTER FOR LABELS	TBD	0.50	2.50	Vendor
	DADS	A		AUTOMATED POSTAGE METER	TBD	1.00	3.00	Vendor
	DADS	A		BAR CODE SCANNER	TBD	1.00	3.00	Vendor
	DATA LOC/ORD	B		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	DATA LOC/ORD	B		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	DATA LOC/ORD	B		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	SCI. DATA SUP	B		X WINDOW TERMINAL	TBD	0.70	2.70	Vendor
	DB MAINT.	B		WRKSTN W/16MB 664 MB HD	TBD	1.10	3.10	Vendor
	SCHED/EXEC	B		FILE SERVER 6MB RAM 665	TBD	1.00	3.00	Vendor
	ALG. TEST&INT	B		WRKSTN W/16MB 664 MB HD	TBD	1.10	3.10	Vendor
	SCIENCE PROC	B		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	SCIENCE PROC	B		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	SCIENCE PROC	B		WRKSTN W/16MB MEM 665 MB	TBD	1.50	3.50	Vendor
	SCIENCE PROC	B		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	SCIENCE PROC	B		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	SCIENCE PROC	B		WRKSTN W/16MB 664 MB HD	TBD	1.10	3.10	Vendor
	ARCHIVE MGR	B		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	B		RAID STORAGE TECHNOLOGY	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	B		1.5 GB 5.25in WINCHESTER DISK	TBD	0.50	2.50	Vendor
	ARCHIVE MGR	B		OPTICAL TAPE DRIVE/3480 TYPE	TBD	0.50	2.50	Vendor
	INGEST/DIST	B		SERVER	TBD	2.00	4.00	Vendor
		B		LASER PRINTER 4PPM	TBD	1.00	3.00	Vendor
	PGS	B		LASER PRINTER 20PPM	TBD	1.00	3.00	Vendor
	PGS	B		LASER PRINTER 4PPM	TBD	1.00	3.00	Vendor
	DADS	B		LASER PRINTER 20PPM	TBD	1.00	3.00	Vendor
	DADS	B		3480 COMPATIBLE DRIVE W/ACL	TBD	2.50	4.50	Vendor
	DADS	B		8MM CASSETTE TAPE DRIVE	TBD	2.50	4.50	Vendor
	DADS	B		CD-ROM ENCODER/WRITER	TBD	2.00	4.00	Vendor
	DADS	B		OPTICAL DISK DRIVE	TBD	2.00	4.00	Vendor
	DADS	B		OPTIICAL CHARACTER READER	TBD	2.00	4.00	Vendor
	DADS	B		SCANNING SUBSYSTEM	TBD	1.00	3.00	Vendor
	DADS	B		MUTIPRINTER FOR LABELS	TBD	0.50	2.50	Vendor
	DADS	B		BAR CODE SCANNER	TBD	1.00	3.00	Vendor
	DADS	B		HI-END COPIER	TBD	2.00	4.00	Vendor

Note: MDT = MTTR + ALDT

ALDT = 2 hours

A.3 Communications and System Management (CSMS) Maintainability Prediction Data

CSMS COTS Hardware RMA Data For Release IR-1 and A

Site	Subsystem	Rel.	Qty	Item Description	Model	MTTR	MDT	Data Source
EDF	CSS	IR-1	1	Enterprise Comm Server	TBD	1.00	3.00	Vendor*
EDF	MSS	IR-1	1	Enterprise Monitoring Server	TBD	1.00	3.00	Vendor*
EDF	MSS	IR-1	2	Management Workstation	TBD	1.10	3.10	Vendor*
EDF	CSS	IR-1	1	Bulletin Board Server	TBD	1.00	3.00	Vendor*
EDF	CSS	IR-1	1	Printer	TBD	1.00	3.00	Vendor*
GSFC	MSS	IR-1	1	Local Management Server	TBD	1.50	3.50	Vendor*
GSFC	CSS	A	1	Local Comm Server	TBD	1.50	3.50	Vendor*
GSFC	MSS	A	2	Management Workstation	TBD	1.10	3.10	Vendor*
GSFC	CSS	IR-1	2	Printer	TBD	1.00	3.00	Vendor*
GSFC-EOC	CSS	A	1	Local Comm Server	TBD	1.50	3.50	Vendor*
GSFC-EOC	MSS	A	1	Local Management Server	TBD	1.50	3.50	Vendor*
GSFC-EOC	MSS	A	2	Management Workstation	TBD	1.10	3.10	Vendor*
GSFC-EOC	CSS	IR-1	1	Printer	TBD	1.00	3.00	Vendor*
EDC	MSS	IR-1	1	Local Management Server	TBD	1.50	3.50	Vendor*
EDC	CSS	A	1	Local Comm Server	TBD	1.50	3.50	Vendor*
EDC	MSS	A	2	Management Workstation	TBD	1.10	3.10	Vendor*
EDC	CSS	IR-1	1	Printer	TBD	1.00	3.00	Vendor*
LARC	MSS	IR-1	1	Local Management Server	TBD	1.50	3.50	Vendor*
LARC	CSS	A	1	Local Comm Server	TBD	1.50	3.50	Vendor*
LARC	MSS	A	2	Management Workstation	TBD	1.10	3.10	Vendor*
LARC	CSS	IR-1	1	Printer	TBD	1.00	3.00	Vendor*
MSFC	MSS	IR-1	1	Local Management Server	TBD	1.50	3.50	Vendor*
MSFC	CSS	A	1	Local Comm Server	TBD	1.50	3.50	Vendor*
MSFC	MSS	A	2	Management Workstation	TBD	1.10	3.10	Vendor*
MSFC	CSS	IR-1	1	Printer	TBD	1.00	3.00	Vendor*
	SMC	A	6	Router	TBD	0.5	2.5	Vendor*

* = data from similar equipment

Note: MDT = MTTR + ALDT

ALDT = 2 hour

Abbreviations and Acronyms

CCR	Configuration Change Request
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CN	Change Notice
COTS	Commercial Off The Shelf
CSMS	Communications and Systems Management Segment (ECS)
DAAC	Distributed Active Archive Center
DCN	Document Change Notice
DID	Data Item Description
ECS	EODIS Core System
EDC	EROS Data Center (DAAC)
EDS	Electronic Data Systems
EOS	Earth Observing System
EOSDIS	Earth Observing System Data and Information System
EPL	Engineering Parts List
EROS	Earth Resources Observation System
ESDIS	Earth Science Data and Information System (GSFC)
FPMH	Failure Per Million Hours
FOS	Flight Operations Segment (ECS)
GFE	Government Furnished Equipment
GSFC	Goddard Space Flight Center
IDR	Incremental Design Review
ILS	Integrated Logistics Support
LaRC	Langley Research Center (DAAC)
LRU	Line Replaceable Unit
MTBF	Mean Time Between Failure
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration

NPRD	Nonelectronic Parts Reliability Data
PAIP	Performance Assurance Implementation Plan
PDR	Preliminary Design Review
RMA	Reliability, Maintainability, Availability
SDPS	Science Data Processing Segment (ECS)
VCATS	Vendor Costing And Tracking System (ECS)